Name of Project: NASA University Research Centers
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PROJECT DESCRIPTION

The University Research Centers (URC) Program is comprised of multi-disciplinary scientific, engineering and/or commercial research centers at host universities classified as Minority Institutions (MI). URCs offer a broad-based, competitive NASA-related research capability among the Nation's MIs that foster new aerospace, science and technology concepts. Designed to expand the Nation's base for aerospace research and development, URCs provide mechanisms for expanded participation by faculty and students of MIs in mainstream research, and increase the number of underrepresented and underserved U.S. students obtaining advanced degrees in NASA-related fields. URCs are collaborative Centers, conducted in cooperation with NASA's Mission Directorates and NASA Centers that substantially contribute to NASA's space and aeronautics goals and objectives.

There are currently 13 URC projects that are funded at MIs across the nation; including Tribal College and Universities (TCU), Historically Black College and Universities (HBCU), Hispanic Serving Institutions (HSI), as well as Other Minority Institutions (OMI).At this time, the NASA URC Program is currently funding six Hispanic Serving Institutions and seven Historically Black College and Universities. Each of the grantees has aligned its research with at least one of the NASA Mission Directorates. Five institutions conduct Exploration Systems Mission Directorate research; four address the Science Mission Directorate; three contribute to the Aeronautics Research Mission Directorate; and one institution aligns its research with the Space Operations Mission Directorate. The research areas represented by these institutions include: human factors in advanced aeronautic technologies; aviation safety; propulsion and control engineering; aerospace device education; gravitational wave astronomy; coupled aquatic processes in ecosystems from space; climate system observation; optical science; radiation engineering; space exploration technology; bio-technology; and advanced nanoscale materials.

The research alignment with NASA allows the faculty and staff of the various URC projects to drive many of the programmatic goals towards accomplishments and outcomes that are desirable for NASA. This includes creating a higher caliber of students who are prepared for the STEM workforce, hands-on training and knowledge to understand advanced concepts and processes, and the ability to build capacity and share valuable information. As a result, many contributions have been made towards developing the STEM education pipeline to increase the number of underrepresented students obtaining advanced degrees in NASA-related fields, creating research opportunities through the URC institutions, and bridge gaps in research.

PROJECT GOALS

The overall goal of the URC project is to continue NASA's commitment to achieving a broad-based, competitive aerospace research and technology development capability at MIs that will:

- Expand the nation's base for aerospace research and development by fostering new aerospace research and technology development;
- Develop mechanisms for increased participation by faculty and students at MIs in the research programs of NASA's Mission Directorates; and
- Increase the numbers of undergraduate and graduate degrees awarded to U.S. citizens from MIs in NASA-related fields.

There are many ways that the URC program has been successful in addressing each of these goals. Funding for the URC Projects has allowed Project Investigators to revamp laboratory facilities, acquire advanced technologies, and enhance STEM research learning environments. As a result, students have been able to receive training in designing models, developing processes, utilizing equipment and technologies, running

tests, and analyzing results. The FY2010 Annual Research Report shows that 487 students were engaged in research with the URC project. In addition, 196 professional science and technical investigators were involved with the research being conducted at the various URC host institutions. This included scientists from the host institutions as well as external collaborators from other higher education institutions, industry businesses, and NASA. The results of these collaborative efforts include innovative experiments, publications, and a wealth of presentations at the local, state, national, and international level. The FY2010 Annual Research Report shows that there were a total of 341 students, faculty, and other scientific investigators engaged with the URC project that had published results of research and activities. There were also 80 invited papers and 155 self-submitted papers that were presented at conferences.

URC Project Staff continue to develop strategies to recruit and retain underrepresented students in their STEM academic programs. Out of a total of 487 student who were engaged in research with the URC Program, 197 (40%) were identified as Black or African-American and 122 (25%) were identified as Hispanic or Latino. This shows that a total of 65% of underserved students were served by the program for FY2010. This demonstrates that the URC Program exceeds the targeted NASA Higher Education participation rate of 40% for underrepresented students. The FY2010 Project Activity Report also shows that the URC Projects had a total number of 2,153 interaction counts with K-12 teachers and informal educators. This indicates that the URC Program is contributing to the NASA Office of Education target rate to serve 75,000 educators.

Research-based literature provides indicators for success to recruit, retain, and prepare underrepresented students for careers in STEM academic fields. An evaluation on the Model Replication Institutions Program conducted by the Institute for Higher Education Policy (IHEP) provided essentials for minority recruitment, retention, and degree completion in STEM in higher education. The following chart shows how the URC Program design is aligned with those essentials:

Recommendations from IHEP[1]	**NASA URC Project Design**
Faculty and administrative buy-in;	URC projects have institutional commitment.
STEM data collection and assessment;	URC projects report on student, research, and programmatic outcomes.
Financial support of faculty;	Funding for URC projects allow faculty to improve STEM academic programs, develop research activities, and supports the development of products.
Involving students in undergraduate research; and	URC grantees provide valuable research experiences for students.
Nurturing and mentoring students to increase their self-confidence	URC students receive training, advisement, career planning, professional development, and engage in opportunities to learn and work with scientific experts in their respective field of study.

The chart above presents five best practices that can allow for success at Minority Institutions to increase the graduation rate of underrepresented students at their institutions and prepare students for employment in STEM careers. The chart also provides examples of how the URC Program has specific programmatic elements in place that mirror the best practices as recommended by the Institute for Higher Education Policy.

PROJECT BENEFIT TO OUTCOME

As a higher education program within the NASA Office of Education, the assigned program outcome is to 'contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goal through a portfolio of investment'. The URC Program accomplishes this by coordinating a variety of opportunities for students to participate in an experiential learning environment. Many of these experiences

[1]Cullinane, Jenna, and Lacey H. Leegwater. "Diversifying the STEM Pipeline: The Model Replication Institutions Program." Institute for Higher Education Policy. Institute for Higher Education Policy and National Science Foundation, Dec. 2009. Web. 30 Sept. 2011. <http://www.ihep.org/Publications/publications-detail.cfm?id=132>.

result in the form of an internship, fellowship, or cooperative education opportunity. In addition to engaging students in career preparation appointments, URC Project faculty and staff plan and facilitate professional development activities which include participation in professional organization meetings and facilitating training programs. URC Program students also have access to faculty mentors at their institutions, industry advisory members, and NASA scientists. These mentoring relationships allow students to fully understand the challenges and expectations that exist as they make their transition from higher education to employment in STEM. In addition to students having the ability to engage in these experiences, faculty and staff continuously work to develop their undergraduate and graduate programs in STEM. Many of these developments result in the creation of new or revised courses, strategies to raise academic rigor, an increase in academic advisement, and activities designed to prepared students for advanced degree programs.

The URC Program has data collection processes in place to assist the currently funded URC Projects with tracking the progress of their students. The anticipated length of time to complete a degree program for a majority of the URC institutions ranges from two to six years on an average. Many of the URC Projects are in the second or third year of operating their program, and do not currently have a wealth of individuals who have completed their academic degrees at this time. As the projects continue to track the progress of their students, the number of successful students to complete their undergraduate, graduate, and doctoral degree requirements should increase. As the number of students obtaining their degree increases, there will be more students prepared for the workforce.

PROJECT ACCOMPLISHMENTS *(CONNECTION BACK TO ANNUAL PERFORMANCE GOALS AND PLANS)*

The uniqueness of NASA URC Program allows trustworthiness in the projects to produce many accomplishments. For example**,** much of the project design is based on notable best practices in addressing minority institutional competitiveness in regards to education and professional development within STEM. With the URC institution's success in acquiring new laboratories, research facilities, and equipment to allow high quality research activities to take place, many accomplishments have been achieved.

The students and faculty affiliated with the various URCs also have the opportunity to work with scientists at many of the NASA centers nationwide. Many of these collaborations are a result of efforts put forth by NASA URC Program Technical Review Committee members that assist with evaluating the ongoing research and administration that take place at the various URC institutions. Data collected from the FY2010 Project Activity Report shows that there were a total of 48 instances where a NASA URC education program, meeting, or research activity took place at a NASA centers.

Valuable student professional development opportunities have resulted in the form of an internship or fellowship. For example, the Project Activity Report for FY2010 shows that the URC Program had 78 internships and 75 fellowships. The report also shows that many students were able to conduct presentations at conferences and authored publications. There were also a total of five design challenges which included the Reduced Gravity Flight program that is sponsored by Johnson Space Flight Center. Other professional development opportunities include students selected for the NASA Student Ambassadors Program and attendance at the International Astronautical Congress Conference.

Faculty members have also had the opportunity to accomplish a great deal as a result of the research and educational programming being held within their URC Project. In FY2010, the URC Program had one Project Director who received the NASA IT Summit Award. In addition, many faculty members have been able to author a wealth of publications and conduct numerous presentations on their URC research work. URC Project Directors also participate in the Annual Project Director's Meeting which allows them to exchange ideas and identify best practices for URC institutions.

The URC projects produce many unique and valuable products including: the creation of educational materials; websites that can disseminate information; training programs; publications; presentations; technology processes; and patents. One of the most notable contributions, reported in the Program Assessment Rating Tool (PART), is the development of new or revised courses. In FY 2010, the total number of new or revised courses was 49 for the overall program, which reached 5,341 students. Another valuable contribution for the NASA URC Program is the expansion of service reach to K-12 teachers, informal educators, and post-doctoral students resulting in valuable products in the form of training, conferences, enrichment programs, research activities, and the creation of media and curriculum products.

PROJECT CONTRIBUTIONS TO PART MEASURES (*INCLUDE DATA PLUS EXPLANATION)*

The URC Program has compiled data utilizing the Program Assessment Rating Tool (PART) to report out on how the Program is contributing towards performance measures. In FY2010, the URC Program served a total 11,152 undergraduate and graduate students. This total includes all higher education groups served such as those with a significant investment and those who had direct, indirect, and unique URC interactions. This indicates that the URC Program has fulfilled 45% of the NASA Office of Education's target number to serve 25,000 undergraduate and graduate students. In addition, FY2010 data shows that a total of 1,398 students received a significant investment from the URC Program, and that 219 students were placed in the NASA, STEM related industry, or education workforce. This demonstrates that 16% of students who received a significant investment were able to be placed in STEM employment for FY2010. This percentage will increase as more students complete their degree programs during future project years.

A recent publication by Diverse Issues in Higher Education[2] also shows that in 2010, URC institutions ranked high in producing Latino student graduates of undergraduate and graduate degree programs in engineering. Out of the total number of higher education institutions in the nation, Florida International University ranked first and the University of Texas El Paso ranked second in producing graduates at the undergraduate level. Florida International University also ranked second with the University of Texas El Paso ranking fourth in producing Latino graduates at the graduate level. California State University Los Angeles and California State University Long Beach were also ranked within the top 50. This information indicates that the NASA URC Program serves as a resource and supports the pipeline of students who are matriculating through these degree programs.

IMPROVEMENTS (e.g. project management, efficiencies, etc.) MADE IN THE PAST YEAR

The URC Program Management Office continues to develop methods that can help to improve the various URC Projects and monitor their progress to carry on its success in achieving many of the goals and objectives of the Program. One of the improvements to the monitoring process is the requirement of URC sites to participate in an annual site visit. During this time, Program Management Staff, Technical Review Committee members, and Advisory Board members have the opportunity to meet with faculty, staff, and students, and observe URC facilities at the host institution. This also provides an opportunity to learn about the administration of the institution. At the conclusion of a site visit, Technical Review Committee members develop a report that may include recommendations for the URC site.

The tracking of student progression is another improvement that was identified for the Program. URCs have been advised to develop their data collection and student tracking process by creating methodologies that can assist them in tracking their student retention rate, degree completion rate, and work placement rate. In addition, URCs are now required to complete higher education data collection forms and student surveys in the NASA Office of Education Performance System (OEPM) allowing the URC Program to analyze data and develop reports. Other reporting requirements include the quarterly and annual narrative reports which require URCs to respond to the research work, student development, education program, and other goals and objectives that are associated with the Program. URC Projects may also use these reporting opportunities to respond to project management, progress on sustaining their project, and the feasible utilization of funding. The URC Program Management Team has developed templates to assist the URCs with improving their practices in reporting. In addition to utilizing data collection tools in OEPM and completing narrative reports, the URC Projects are required to complete the Program Assessment Rating Tool (PART) that specifically collects data to support the Program's Annual Performance Goals.

One of the most important components that the URCs are required to develop is a strategy to sustain their project beyond program funding. Although many of the URC sites have been successful in acquiring additional funding and securing partnerships for their projects, the URC Program continuously monitors this progress and encourages the various projects to achieve this goal. The URC Program Management Team

[2] *Recruitment and Retention*. Rep. Diverse Issues in Higher Education, 2011. Print

also assists with identifying NASA opportunities for students and faculty as a way to leverage resources for the Projects.

PROJECT PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

URC institutions are required to discuss their status in acquiring and maintaining partnerships throughout each project year. The design of partnerships varies in design, implementation, funding, and resources. URC institutions have the ability to report on the nature of their partnerships within narrative reports, during site visit discussions, and data collection via the OEPM System. The development and maintenance of long-term partnerships is vital to the sustainability of the URC projects.

Reviews of reports and FY2010 data collection forms identify the various entities that the URC projects partnered with in FY2010. For example, the FY2010 Project Activity Report shows that URC projects had partnerships with 48 higher education institutions including Northwestern University, Stanford University, Purdue University, and University of Southern California. North Carolina Central University's URC also partnered with technical schools such as Wake Technical College and Durham Technical College. The FY2010 Annual Research Report also shows that the URC projects had partnerships and funding with a number of federal agencies including the U.S. Department of Energy, U.S. Department of Defense, National Institute of Health, Jefferson National Laboratory, National Renewable Energy Laboratory, Oak Ridge National Laboratory, National Science Foundation, and the U.S. Department of Education. Many of these federal partnerships provided additional funding support for the projects. URC projects also developed partnerships with industry organizations such as Boeing, Amgen, IBM, El Paso Science Network, and others who have assisted with teaching courses, provided advisement, and met research needs. Additionally, the University of Puerto Rico has a partnership with Coalicion Educativa Junquena which is a non-profit organization. Some of our URC projects collaborate on a global level, resulting in valuable international partnerships. International collaborators identified for the URC Projects include Kyushu Institute of Technology in Japan, University College London located in the United Kingdom, and the Instituto de Astronomia y Fisica del Espacio Buenos Aires located in Argentina.

Overall, the design of the URC Program has proven to be valuable as a result of the project placement at academic higher education institutions that have been identified as Minority Serving Institutions. This placement allows the URC institutions to serve as a resource to the immediate and global community, and allows easy access to those students who are from underrepresented target groups. URC projects are not only supported by NASA and other partnerships that have been identified, but are internally supported by academic and non-academic departments at their institutions. Additionally, the unique design of a URC project has allowed our projects to extend STEM education opportunities and targeted exposure to research in the format of education outreach, summer enrichment programming, trainings, seminars, poster presentations, tutoring programs, symposiums, and the development of new degree programs at the institutions. Future development for the NASA URC Program includes assisting URC sites with ensuring sustainability, documenting the progress of the currently funded projects, and strategizing with the NASA Office of Education on how to best utilize funding while improving the program design. Best practices are also under review, and will be evaluated against the success of the projects in the long-term. The URC Program also anticipates a 20 year evaluation that will provide further insight on the success of the URC projects and its affiliates.